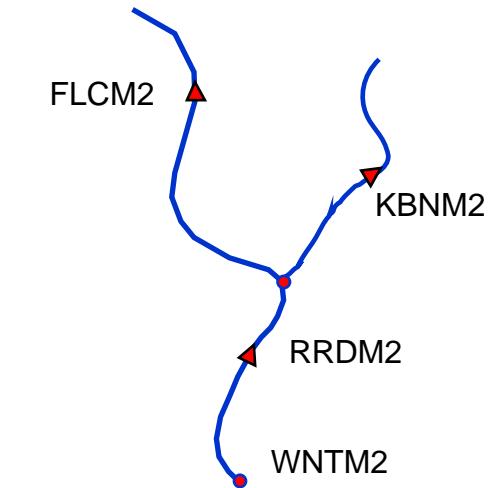




General Information

RES-J Joint Reservoir Model

- Designed as a network model to solve a system of reservoirs, reaches, and nodes.
- Fully integrated within NWSRFS as an operation in the calibration, forecast, and ensemble streamflow prediction systems
- Facilitates long-term simulations of individual reservoirs or systems of reservoirs
- Easily extended by adding new modeling methods
- Uses explicit simulation approach



Operations Table:

LAG-K	KLGN1
SAC-SMA	LOCAL
UNIT-HG	LOCAL
ADD-SUB	INF_TOT
RES-J	WINSTON
PLOT-TUL	INFLOW
PLOT-TUL	RES_OP

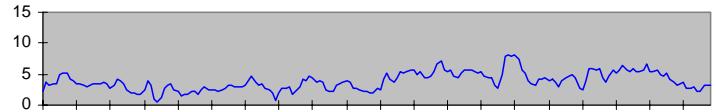
Explicit Solution Considerations

- ♥ Model states at the beginning of the time step are used to determine release at the end of the time step
- ♥ Model states at the end of the time step are computed based on inflows and outflows averaged over the time step
- ♥ Eliminates need to input mean inflows to the model; simplifies the solution technique
- ♥ May require smaller time steps; requires special handling to avoid numerical instabilities;
- ♥ Correct time step a function of rate of change of storage, inflow magnitude, rate of change of inflow, rate of change of outflow

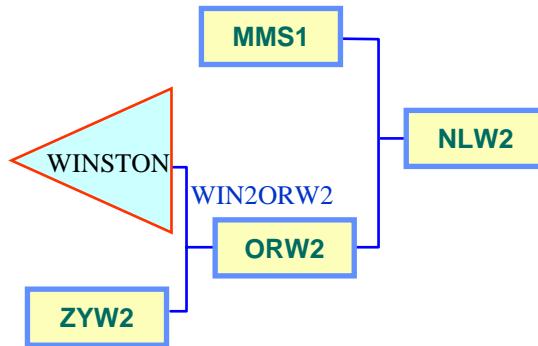
RES-J Input Sections

✿ Time series

```
WINT2 QINE 6  
WINT2 RQOT 6  
. .
```



✿ Topology



✿ Parameters

```
[ TRUE ]
```

```
RAINEVAP WINSTON SURFACE
```

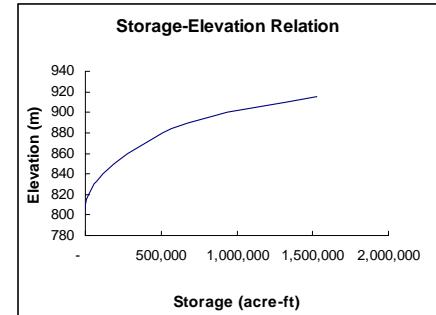
```
[ WINSTON POOL < 831.5 ]
```

```
SETRELEASE WINSTON NORMAL
```

```
[ WINSTON POOL > 831.5 ]
```

```
SETRELEASE WINSTON FLOOD_OPS
```

✿ Rules



RES-J Time Series Information

- ❖ All time series used in RES-J must be included in the segment definition containing the RES-J operation
- ❖ All time series used in RES-J must be identified separately within the RES-J model input section
- ❖ Time series can be assigned aliases for reference throughout the model

```
LOYALHANNA Reservoir
1 1970    12 1980    ENG

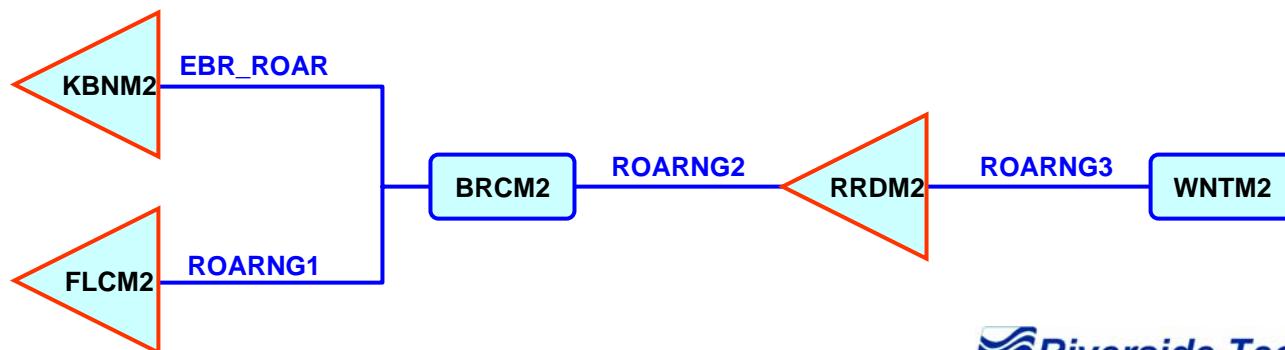
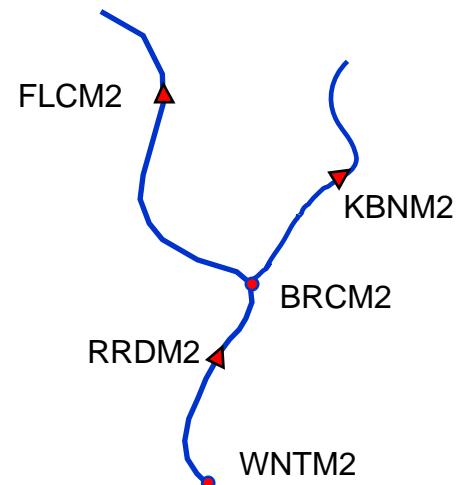
DEF-TS
SLTP1      RQIN      6          INPUT
agl/RQIN/sltp70_00.rqin06
SLTP1      PELV      6          INPUT
agl/PELV/sltp70_00.pelv06
SLTP1      RQOT      6          INPUT
agl/RQOT/sltp70_94.rqot06
SLSIMRL    SQIN      6          OUTPUT
agl/RQIN/loysimrel.sqin06
SLSIMEL    SPEL      6          OUTPUT
agl/PELV/loysimpel.sqin06
SLOBSSLR   RQME      24         OUTPUT
SLSIMRL    SQME      24         OUTPUT
agl/QME/SLSIMRL.SQME24
SLSIMEL    SPEL      24         OUTPUT
agl/PELV/SLSIMEL.SPEL24
END
RES-J      SLTP1
TIMESERIES
TIMESERIES
  TIMESTEP    6
  INPUT   SLTP1    RQIN    6    TOT_INFL
  INPUT   SLTP1    PELV    6    OBS_ELEV
  OUTPUT  SLSIMRL  SQIN    6    SIM_RELS
  OUTPUT  SLSIMEL  SPEL    6    SIM_POOL
ENDTIMESERIES
TOPOLOGY
  RESERVOIR    LOYALHANNA
ENDTOPOLOGY

PARAMETERS
```



RES-J Topology Information

- Topography defines the connectivity of the network components: Reservoirs, Reaches, Nodes
- Components must be defined from upstream to downstream
- Each component may have many upstream components
- Each component may have at most one downstream component

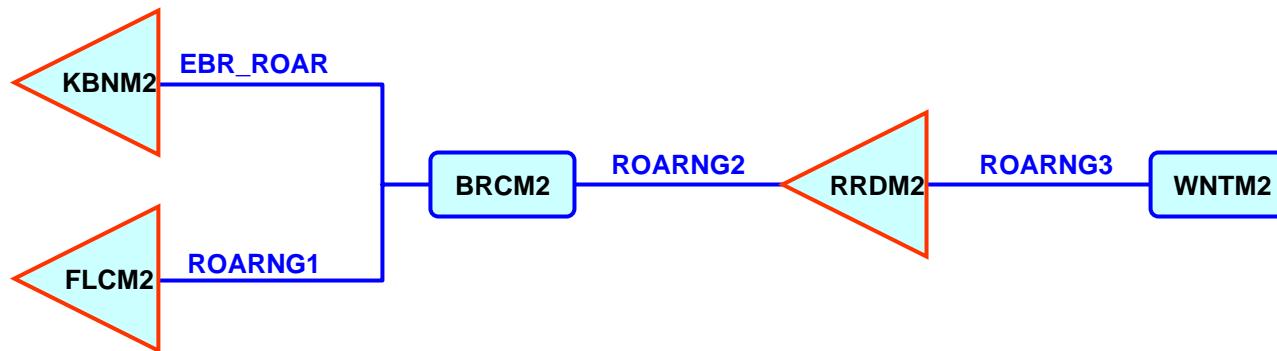
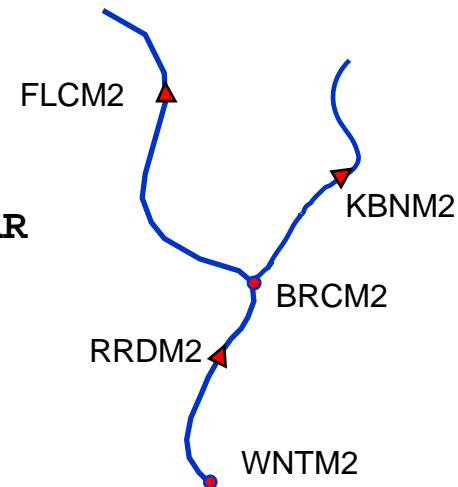


RES-J Topology Example

TOPOLOGY

RESERVOIR	FLCM2
RESERVOIR	KBNM2
REACH	ROARNG1 BELOW FLCM2
REACH	EBR_ROAR BELOW KBNM2
NODE	BRCM2 BELOW ROARING BELOW EBR_ROAR
REACH	ROARNG2 BELOW BRCM2
RESERVOIR	RRDM2 BELOW ROARNG2
REACH	ROARNG3 BELOW RRDM2
NODE	WNTM2 BELOW ROARNG3

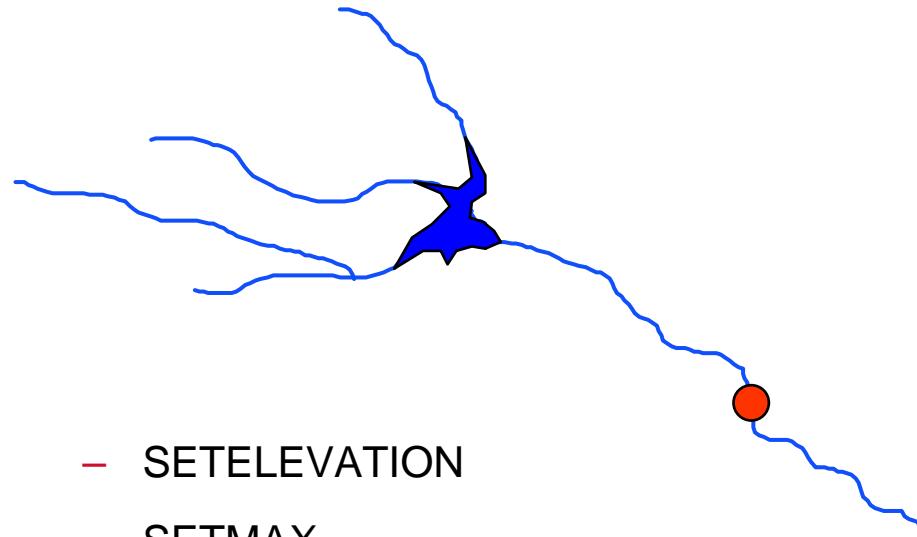
ENDTOPOLOGY



RES-J Parametric Information

◆ Components

- Reservoirs
- Reaches
- Nodes

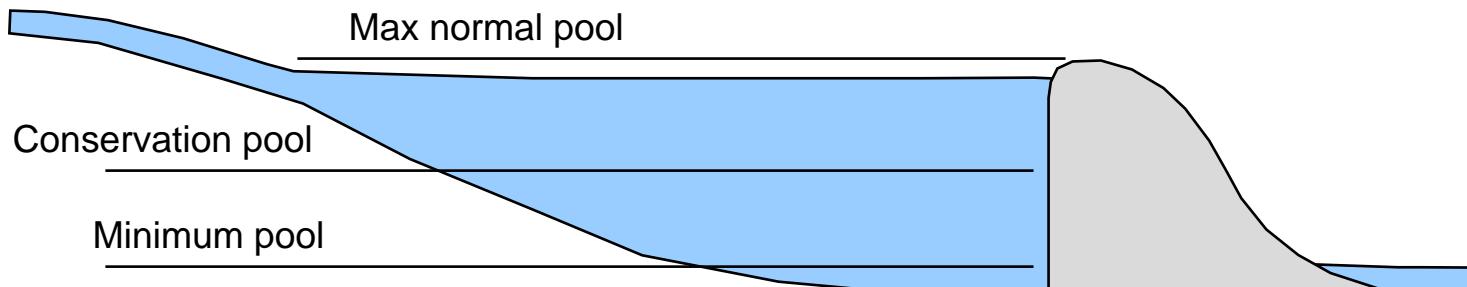
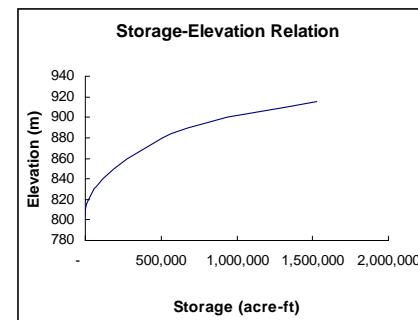
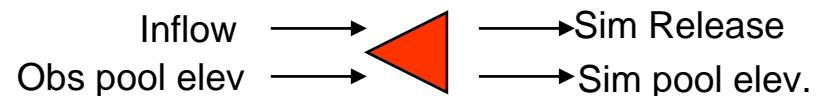


◆ Methods

- ADJUST
- BALANCE
- LAGK
- MAXDECREASE
- MAXINCREASE
- MAXSTAGE
- RAINEVAP
- SETELEVATION
- SETMAX
- SETMIN
- SETRELEASE
- SETSUM
- SETWITHDRAW

Reservoir Component Parameters

- Input and output time series
- Elevation versus storage table
- Initial pool and release values
- Minimum pool value
- Constants



Reservoir Component Parameters

PARAMETERS

UNITS ENGLISH

RESERVOIR WINSTON

CONSTANT WINSTON.CONS_POOL 205.0

TSINPUT INFLOW WIN_INFLOW

TSINPUT POOL WIN_OBS_POOL

TSOUTPUT RELEASE WIN_SIM_REL

TSOUTPUT POOL WIN_SIM_POOL

TABLE ELEV_STOR

72.0 0.0

205.0 50000.0

210.0 55000.0

212.0 60000.0

ENDTABLE

INITIALPOOL 206.0

INITIALRELEASE 1200.0

INITIALWITHDRAW 85.0

MINPOOL 75.0

MINRELEASE 15.0

ENDRESERVOIR

ENDPARAMETERS

Reach Component Parameters

- Input time series
- Output time series

PARAMETERS

UNITS ENGLISH
RESERVOIR ...
•
•

ENDRESERVOIR

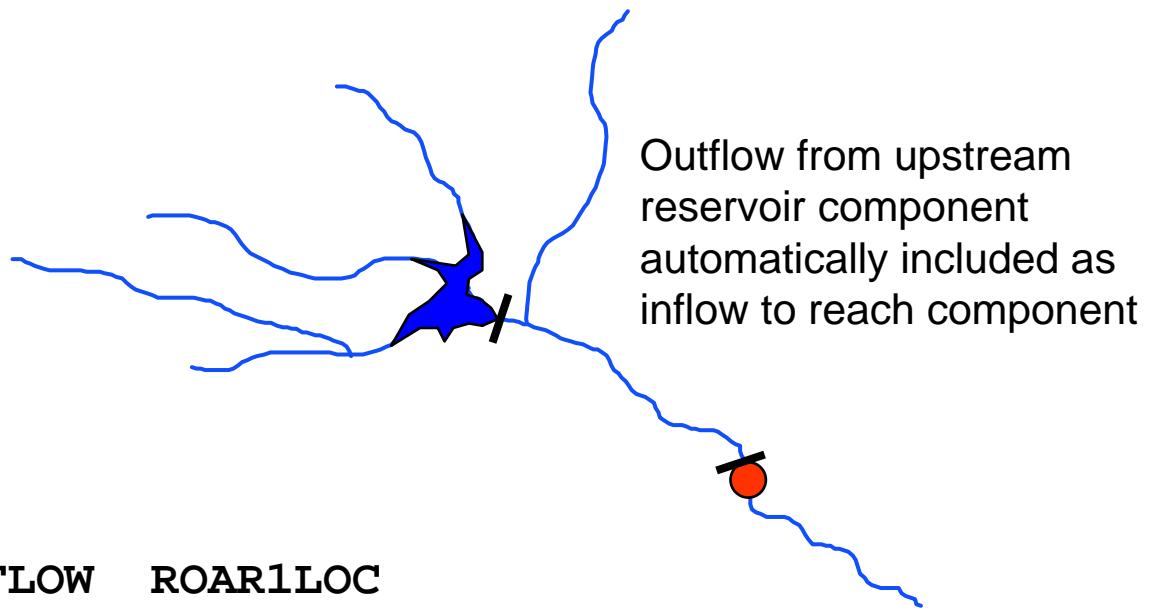
REACH ROARNG1

TSINPUT INFLOW ROAR1LOC

TSOUTPUT OUTFLOW ROAR1LAG

ENDREACH

ENDPARAMETERS

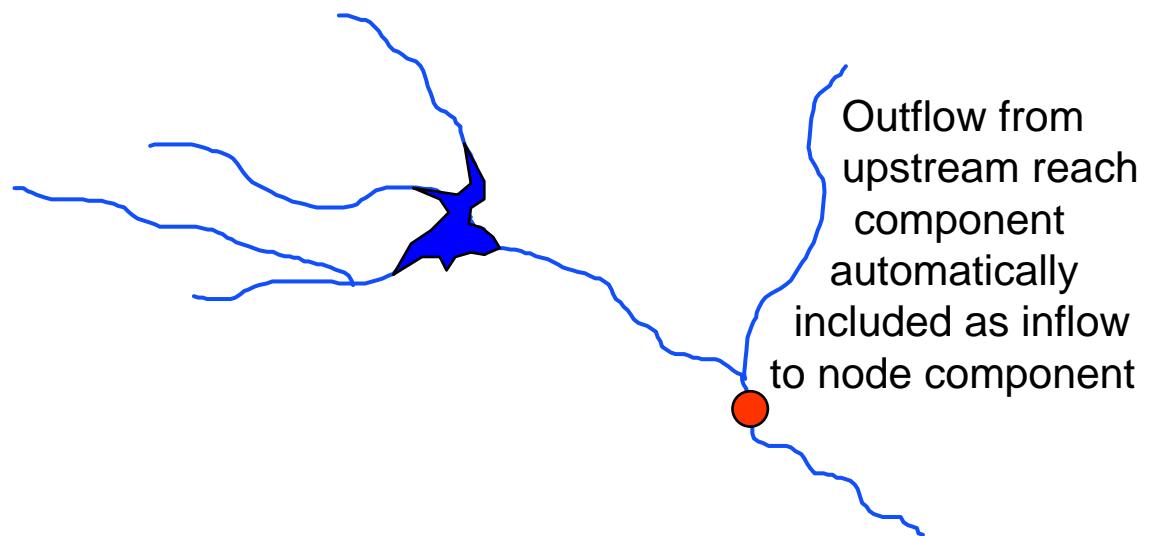


Node Component Parameters

- Input time series
- Output time series

PARAMETERS

```
UNITS ENGLISH
RESERVOIR ...
.
ENDRESERVOIR
REACH ...
.
ENDREACH
NODE WNTM2
    TSINPUT INFLOW WNTM2LOC
    TSOUTPUT OUTFLOW WNTM2TOT
ENDNODE
ENDPARAMETERS
```



RES-J Rules Information

Rules are specified using [expression] - [method] syntax

If *expression* evaluates to TRUE, the listed *methods* are executed

Use of compound expressions is supported

Expressions are written in terms of component states, dates, constants, and Boolean operators

RES-J Rules Examples

RULES

```
#Executed every time step
```

```
[ TRUE ]
```

::SETWITHDRAW	Madden	Mad_Muni
::SETSUM	Madden	Power&Spills
::LAGK	Chagres	ChagresLAGK

```
#Conditional Execution
```

```
[Madden.Pool < Madden.Drought]
```

::SETELEVATION	Madden	Mad_pool_205
----------------	--------	--------------

ENDRULES